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Matthew Pearl, Associate Bureau Chief  
Wireless Telecommunications Bureau  
Ira Keltz, Deputy Chief  
Office of Engineering and Technology  
Federal Communications Commission  
45 L Street NE  
Washington, DC 20554

**VIA ELECTRONIC MAIL**

Re: Co-existence Between Phase I C-band Deployments and Radio Altimeters

Dear Messrs. Pearl and Keltz:

AT&T Services, Inc., on behalf of AT&T, Inc. and its affiliates (“AT&T”), submits this letter in response to the above-referenced correspondence from the Wireless Telecommunications Bureau and the Office of Engineering and Technology of the Federal Communications Commission (“Commission” or “FCC”) dated December 30, 2021.<sup>1</sup> The *FCC C-band Letter* acknowledges the joint letter filed by AT&T and Verizon on November 24, 2021,<sup>2</sup> acknowledges the Commission’s careful review of the coexistence issues, and seeks to memorialize the precautionary measures (“Precautionary Measures”) set forth in that letter under Section 1.17 of the Commission’s rules.<sup>3</sup> While AT&T recognizes the paramount importance of air safety, evidence on the record to date—including filings since the *AT&T/Verizon Joint Letter*<sup>4</sup>—plainly demonstrate that AT&T’s use of C-band spectrum to provide 5G service will not undermine that imperative. Nonetheless, AT&T reiterates below and reaffirms the Precautionary Measures from the *AT&T/Verizon Joint Letter*.

As AT&T and Verizon discussed in the *AT&T/Verizon Joint Letter*, the launch of commercial 5G operations using mid-band spectrum acquired in the Commission’s record-breaking \$80

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<sup>1</sup> Letter from Joel D. Taubenblatt, Acting Chief, Wireless Telecommunications Bureau, and Ronald T. Repasi, Acting Chief, Office of Engineering and Technology, Federal Communications Commission, to Joan Marsh, Executive Vice President, Federal Regulatory Relations AT&T Services, Inc. in re: Co-existence Between Phase I C-band Deployments and Radio Altimeters (dated Dec. 30, 2021) (“*FCC C-band Letter*”).

<sup>2</sup> Letter from Joan Marsh, Executive Vice President of Federal Regulatory Relations, AT&T Services, Inc., and Kathleen M. Grillo, Senior Vice President – Public Policy & Government Affairs, to The Honorable Jessica Rosenworcel, Chairwoman, Federal Communications Commission, GN Docket No. 18-122 (dated Nov. 24, 2021) (“*AT&T/Verizon Joint Letter*”).

<sup>3</sup> 47 C.F.R. § 1.17.

<sup>4</sup> See Letter from Jeffrey A. Marks, Vice President, Regulatory Affairs North America, Nokia, GN Docket No. 18-122 (dated Dec. 10, 2021); Letter from Kara Graves, Assistant Vice President, Regulatory Affairs, CTIA, GN Docket No. 18-122 (dated Dec. 21, 2021).

billion C-band auction is imminent.<sup>5</sup> Acquisition of rights to early access of that spectrum—which required an additional commitment of \$15 billion to satellite users—was expressly made in reliance on technical ground rules that were found by the FCC to protect other uses, including radio altimeter operations. The investment by AT&T will dramatically expand the reach and capabilities of the Nation’s next generation 5G networks, advance U.S. leadership, and bring enormous benefits to consumers and to the U.S. economy. This spectrum will be the backbone of AT&T’s 5G network for many years to come and the massive benefits of the C-band should not be delayed or impaired.

Notably, AT&T and Verizon voluntarily adopted the Precautionary Measures set forth in the *AT&T/Verizon Joint Letter* despite the absence of any credible evidence that 5G deployments in the C-band will adversely affect radio altimeters in aircraft, as is confirmed by real-world experience around the globe:

- The FCC itself found—after 17 years of global study and interagency dialogue across all relevant federal agencies—that “the technical rules on power and emission limits we set for the 3.7 GHz Service and the spectral separation of 220 megahertz should offer all due protection to [radio altimeter] services in the 4.2-4.4 GHz band.”<sup>6</sup>
- 5G systems have been deployed in the C-band in nearly 40 countries—with over a hundred thousand operating base stations—without any reported incidents of harmful interference to radio altimeters and without the FAA expressing any concern regarding the safety of U.S.-registered aircraft operating in those locations.<sup>7</sup>
- Live flight testing by the French military<sup>8</sup> and the Norwegian Communications Authority<sup>9</sup> has also confirmed that C-band 5G operations safely coexist today with radio altimeter

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<sup>5</sup> Wireless Telecommunications Bureau Grants Auction 107 Licenses, *Public Notice*, DA 21-839 (rel. July 23, 2021).

<sup>6</sup> *Expanding Use of the 3.7-4.2 GHz Band*, 35 FCC Rcd 2342, 2485 (¶ 395) (2020) (“*C-band Order*”) (also stating that “we are providing a 220-megahertz guard band between new services in the lower C-band and radio altimeters” that “is double the minimum guard band requirement discussed in initial comments by Boeing and [others]” and finding that “the . . . study [underlying claims of interference to altimeters] does not demonstrate that harmful interference would likely result under reasonable scenarios (or even reasonably ‘foreseeable’ scenarios)”).

<sup>7</sup> Letter from CTIA, GN Docket No. 18-122 at 1 (dated Nov. 3, 2021) (“*CTIA Nov. 3 Letter*”).

<sup>8</sup> *CTIA Nov. 3 Letter* at 5 (citing Outcome from preliminary trial on one type of radio altimeter fitted on helicopter, ECC PT1(21)(192) (issued Sept. 6, 2021), [https://www.cept.org/Documents/ecc-pt1/65970/ecc-pt1-21-192\\_france-radioaltimeter](https://www.cept.org/Documents/ecc-pt1/65970/ecc-pt1-21-192_france-radioaltimeter)).

<sup>9</sup> *Id.* (citing 3 Results of the preliminary test of compatibility between MFCN operating in 3400-3800 MHz and Radio Altimeters (RA) operating in 4200-4400 MHz, ECC PT1(21)(184) (issued Aug. 2, 2021), [https://www.cept.org/Documents/ecc-pt1/65941/ecc-pt1-21-184\\_norway-results-of-the-preliminary-testof-compatibility-between-mfcn-operating-in-3400-3800-mhz-and-radio-altimeters-operating-in-4200-4400-mhz](https://www.cept.org/Documents/ecc-pt1/65941/ecc-pt1-21-184_norway-results-of-the-preliminary-testof-compatibility-between-mfcn-operating-in-3400-3800-mhz-and-radio-altimeters-operating-in-4200-4400-mhz))).

operations and the FAA itself acknowledged “[t]here have not yet been proven reports of harmful interference due to wireless broadband operations internationally.”<sup>10</sup>

- Radio altimeters also currently coexist near other high-power radio uses in the U.S. without the reports of harmful interference that RTCA’s methodology would predict, including multiple Navy RADARs<sup>11</sup> and aeronautical telemetry systems;<sup>12</sup> and radio altimeters will coexist co-channel with the aviation industry’s own Wireless Avionics Intra-Communications (“WAIC”) systems.<sup>13</sup>

The *AT&T/Verizon Joint Letter* also observed that the *RTCA Report*—which is the primary basis for the FAA’s and radio altimeter stakeholders’ erroneous claims of harmful interference—has been thoroughly debunked<sup>14</sup> and consistently dismissed by regulators around the globe.<sup>15</sup> The *RTCA Report* has significant documented flaws that more than negate all of RTCA’s claims of

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<sup>10</sup> Risk of Potential Adverse Effects on Radio Altimeters, Special Airworthiness Information Bulletin, AIR-21-18 at 1 (FAA dated Nov. 2, 2021) (also recognizing that in the U.S., mobile broadband commercial services already operate in the 3.550-3.700 GHz MHz band, just at the lower edge of the C-band, “with no known issues for altimeters to date”).

<sup>11</sup> *CTIA Nov. 3 Letter* at 5; Letter from CTIA, GN Docket No. 18-122 at Annex A p. 19 (dated Sept. 3, 2021) (“*CTIA Sept. 3 Letter*”).

<sup>12</sup> *Id.*

<sup>13</sup> Letter from CTIA, GN Docket No. 18-122 at Attachment, p. 7 (dated Aug. 31, 2021).

<sup>14</sup> See *CTIA Sept. 3 Letter* at Annex A.

<sup>15</sup> The Australian regulator stated that it views the *RTCA Report* as “conservative” and “consider[s] that compatibility with radio altimeters can be successfully managed with [wireless broadband] services introduced up to 4000 MHz.” Australian Communications and Media Authority, Replanning the 3700-4000 MHz Band, Outcomes Paper at 3 (dated Jan. 2021); available at: [https://www.acma.gov.au/sites/default/files/2021-01/Replanning%20the%203700-4200%20MHz%20band\\_Outcomes%20paper.docx](https://www.acma.gov.au/sites/default/files/2021-01/Replanning%20the%203700-4200%20MHz%20band_Outcomes%20paper.docx). The Chief Expert, Avionics and Electrical Systems, for the European Union Aviation Safety Agency (“EASA”) determined there is no need for immediate action, stating “[w]e believe that just having the [RTCA Report] is not sufficient evidence. We’re not seeing many occurrences. In fact, on the 5G case we haven’t seen any, and we really need to have a solid basis in our regulatory system to take action.” 5G Signal Interference with Aviation Radar Altimeters (RADALTs) at 15:01; available at: <https://www.icao.tv/videos/anc-talk-5g>. EASA has also stated “[f]or the time being, EASA does not identify any conditions that compromise safety and reports no occurrences of interference from 5G base stations to aeronautical radio altimeters. EASA is following the issue closely and has issued a Continued Airworthiness Review Item addressed to all radio altimeter manufacturers.” Commission Activities related to radio spectrum policy, European Commission, Directorate-General for Communications Networks, Content and Technology, Radio Spectrum Policy Group, RSPG21-018 FINAL at 5 (dated June 16, 2021); available at: [https://rspg-spectrum.eu/wp-content/uploads/2021/06/RSPG21-018final\\_commission\\_activities.pdf](https://rspg-spectrum.eu/wp-content/uploads/2021/06/RSPG21-018final_commission_activities.pdf). A spokesman for the Civil Aviation Authority (“CAA”) in the United Kingdom said that “[w]e are aware of reports that suggest that the frequency band being used for 5G in a number of countries could potentially pose a risk of interference with aircraft radio altimeters,” but noted “[t]here have been no reported incidents of aircraft systems being affected by 5G transmissions in UK airspace.” A spokesman for Ofcom, the UK spectrum regulatory authority, said “[w]e’re aware that the aviation sector is looking at this; we’ve done our own technical analysis and are yet to see any evidence that would give us cause for concern.” No evidence that 5G poses risk to planes, say regulators, *The Daily Telegraph* (dated Nov. 5, 2021); available at: <https://www.telegraph.co.uk/business/2021/11/05/5g-no-threat-uk-aircraft-safety-watchdog-insists/>.

harmful interference, including using unrealistic models of 5G networks, combining multiple worst-case inputs, creating implausible test scenarios, and utilizing extreme testing standards.<sup>16</sup>

Recent—but extremely belated—data filed by the Aviation Vehicle Systems Institute (“AVSI”) confirms these criticisms.<sup>17</sup> The report shows that AVSI data on the Interference Threshold Mask (“ITM”) created as an input to the *RTCA Report* is an aggregate where—as the wireless industry has suspected—results from two extremely poorly performing altimeters are attributed to altimeters across the board in multiple usage categories. One of those flawed models is a pulsed altimeter, a design the FCC has not certified in 30 years, and the other appears to lack any front-end filter at all. With massive—60 million percent—variations between the results from one of the poorly performing radio altimeter models and another model in the same tests, the AVSI data confirms that the *RTCA Report*’s aggregate-driven results are profoundly overstated. The AVSI data also makes clear that any engineering conclusions that are inadvisably drawn from the deeply flawed RTCA methodology should be strictly and narrowly applied only to a small number of specific altimeter models, and not generalized to a broad group of altimeters so as to dramatically diminish the public benefits of 5G.<sup>18</sup>

In that regard, C-band spectrum is crucially important to having robust, world-class 5G networks in the United States. C-band spectrum provides the high capacity and broad geographic range needed for broad and deep 5G coverage—coverage that will enable 5G to drive technological innovation and that are critical to the U.S.’s global leadership in 5G products and services. Delaying the initiation of commercial 5G service using C-band, or substantially impairing the utility of C-band spectrum, will put the U.S. at a competitive disadvantage and potentially risk the integrity and security of our networks.

While remaining confident that 5G poses no risk to air safety, AT&T and Verizon nonetheless voluntarily committed to undertake, for a period of six months,<sup>19</sup> the Precautionary Measures to accommodate the Federal Aviation Administration’s (“FAA’s”) desire for additional analysis. As noted by the Commission, the Precautionary Measures are “one of the most comprehensive efforts in the world to safeguard aviation technologies.”<sup>20</sup> AT&T’s statement regarding compliance with the Precautionary Measures and other statements requested in the *FCC C-band*

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<sup>16</sup> *CTIA Sept. 3 Letter* at Annex A, p. 3.

<sup>17</sup> Letter from AVSI, GN Docket No. 18-122 (dated Dec. 6, 2021); *see also* Letter from AVSI, GN Docket No. 18-122 (dated Dec. 22, 2021). Despite acknowledging that the wireless industry had been seeking information in the report for over a year, and despite that the report contains no confidential information, the data was withheld by AVSI and only recently entered in the record.

<sup>18</sup> AVSI’s data also requires consideration of why—given the ICAO report the study was initiated to address, the aviation industry has essentially ignored the existence of radio altimeters with such poor design to persist for over five years without any remedial action.

<sup>19</sup> The commitment by AT&T will expire on July 6, 2022, unless credible evidence exists that real-world interference would occur if the mitigations were relaxed.

<sup>20</sup> Matt Daneman, *AT&T, Verizon Limit C-Band Deployments Near Airports, Helipads Through July 6*, *Communications Daily*, at 2 (Nov. 26, 2021) (quoting FCC spokesperson).

*Letter*, are set forth in the attached certification of Christopher Sambar, Executive Vice President of AT&T.<sup>21</sup>

Although AT&T remains committed to the rapid deployment of 5G and the safety of aviation, the Precautionary Measures significantly restrict AT&T's ability to fully utilize its C-band licenses for 5G services. Accordingly, AT&T urges the Commission—and the FAA—to rapidly conclude any further analysis and terminate this proceeding.

Respectfully submitted,

AT&T SERVICES, INC.

By: /s/  
Joan Marsh  
Executive Vice President of Federal  
Regulatory Relations

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<sup>21</sup> The *FCC C-band Letter* also requests that AT&T's certification state that "all of the information requested by this letter that is in AT&T's possession, custody, control, or knowledge have been produced." Because the *FCC C-band Letter* does not request any information, the statement has been omitted.

## CERTIFICATION

I, Christopher Sambar, Executive Vice President for Technology Operations, without waiver of AT&T's legal rights associated with our substantial investments in these licenses, hereby certify under penalty of perjury that: (i) AT&T will, in each of the Partial Economic Areas in which AT&T holds C-band licenses, implement the Precautionary Measures, reiterated below without modification, prior to initiating service, and that the Precautionary Measures will remain in place until at least July 6, 2022, absent further action by the Commission; and (ii) AT&T's base stations will comply with 3GPP standards for C-band out-of-band emissions during the Commitment Period. Specifically, with respect to the Precautionary Measures, AT&T confirms that it will:

1. Limit C-band effective isotropic radiated power ("EIRP") above the horizon for all 5G base stations to no more than the lesser of: (a) 62 dBm/MHz or (b)  $48 + 20 \times \log_{10}(1/\sin(\Theta))$  dBm/MHz, where  $\Theta$  is the elevation angle above the horizontal plane of the base station antenna.
2. Limit C-band EIRP below the horizon for all 5G base stations to no more than 62 dBm/MHz.
3. In addition, for all public use Airports with paved runways:<sup>22</sup>
  - 3.1 Limit C-band power flux density ("PFD")<sup>23</sup> to a maximum of -30 dBW/m<sup>2</sup>/MHz within the horizontal plane surface 300 feet above the established airport elevation described by swinging arcs of 1 nautical mile (6,076 feet) radius from the center of each end of the primary surface of each paved runway and connecting the adjacent arcs by lines tangent to those arcs.<sup>24</sup>
  - 3.2 Limit C-band PFD to a maximum of -31 dBW/m<sup>2</sup>/MHz at the surface of all paved runways, within the boundaries of the runway edges and runway threshold lines.
  - 3.3 Limit C-band PFD to a maximum of -19 dBW/m<sup>2</sup>/MHz at the surface of all paved aprons and paved taxiways (i.e., movement and non-movement areas).
  - 3.4 Limit C-band EIRP from 5G base stations to no more than 37 dBm/MHz in a rectangular area centered on the runway centerline with a length extending to

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<sup>22</sup> The public use airports will include those facilities identified by searching for "facility type" of "airport" and "facility use" of "public" from <https://adip.faa.gov/agis/public/#/airportSearch/advanced> as of the date of this letter, as well as any additional facilities agreed to by the FAA, AT&T, and Verizon.

<sup>23</sup> All PFD limits set in this document will be based on using minimum operational loss of no less than 2 dB below the maximum.

<sup>24</sup> This is the "horizontal surface" defined in 14 C.F.R. § 77.19(a), but with a horizontal plane 300 feet above the airport and with the radius of the arc being 1 nautical mile. See, e.g., United States Standard for Terminal Instrument Procedures, Order 8260.3E at p. 2-59, Figure 2-7-1 (FAA Sept. 17, 2020); available at: [https://www.faa.gov/documentLibrary/media/Order/Order\\_8260.3E.pdf](https://www.faa.gov/documentLibrary/media/Order/Order_8260.3E.pdf).

1,000 feet beyond the runway threshold at each end of the paved runway, and laterally from the extended centerline, up to and including 600 feet on either side.

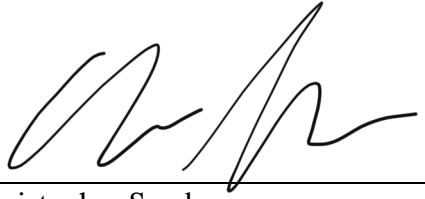
- 3.5 Limit C-band EIRP from 5G base stations to no more than 55 dBm/MHz EIRP in the area from 600 feet laterally up to and including 1,000 feet laterally on either side of the runway centerline extended to 1,000 feet beyond the runway threshold at each end of the runway.
- 3.6 Base stations within the Final Approach Box (“FAB”), as defined below, at either end of all paved runways, will:
  - 3.6.1 Use C-band antennas that do not exceed a centerline height equivalent to a 50:1 approach surface above the touchdown zone elevation beginning at the primary surface, where the touchdown zone elevation is the highest elevation along the first 3,000 feet of the runway at that end of the runway<sup>25</sup> and the primary surface is a surface longitudinally centered on a runway that extends 200 feet beyond each end of that runway.<sup>26</sup>
  - 3.6.2 Limit C-band EIRP above the horizon to no more than the lesser of: (a) 62 dBm/MHz or (b)  $39 + [0.005788 \times (D_m - 305m)] + [20 \times \log_{10}(1/\sin(\Theta))]$  dBm/MHz, where  $D_m$  is the horizontal distance from the base station to the runway threshold and  $\Theta$  is the elevation angle above the horizontal plane of the base station antenna.
  - 3.6.3 For purposes of 3.6.1 and 3.6.2, the FAB is defined as an isosceles trapezoid with its short side (top) orthogonal to the runway centerline (extended beyond the runway threshold), centered on the extended runway centerline, with the top positioned 1,000 feet from the runway threshold away from the runway, with a height of 5,100 feet, and with a long side (bottom) that is 3,772 feet.

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<sup>25</sup> IFP Requirements (FAA last modified July 31, 2020), available at: [https://www.faa.gov/air\\_traffic/flight\\_info/aeronav/procedures/ifp\\_initiation/ifp\\_requirements/](https://www.faa.gov/air_traffic/flight_info/aeronav/procedures/ifp_initiation/ifp_requirements/).

<sup>26</sup> 14 C.F.R. § 77.19(c), for paved runways.

4. In addition, for all public use Heliports,<sup>27</sup> limit C-band PFD to no more than -16 dBW/m<sup>2</sup>/MHz on the primary surfaces of helipads.<sup>28</sup>

/s/   
By: Christopher Sambar  
EVP-Techology Operations

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<sup>27</sup> The public use heliports will include those facilities identified by searching for “facility type” of “heliport” and “facility use” of “public” from <https://adip.faa.gov/agis/public#/airportSearch/advanced> as of the date of this letter, as well as any additional facilities agreed to by the FAA, AT&T, and Verizon.

<sup>28</sup> 14 C.F.R. § 77.23(a).